

PROJECT NARRATIVE AND STORMWATER ANALYSIS

255 Low Street (Rear)

Newburyport, MA

November 8, 2017

Rev. January 29, 2018

Submitted to:

Newburyport Planning Board & Conservation Commission
City Hall
60 Pleasant Street
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1. DEP Stormwater Checklist



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Stephen Sawyer

Oct. 19, 2017

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- New development
- Redevelopment
- Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- No disturbance to any Wetland Resource Areas
- Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- Reduced Impervious Area (Redevelopment Only)
- Minimizing disturbance to existing trees and shrubs
- LID Site Design Credit Requested:
 - Credit 1
 - Credit 2
 - Credit 3
- Use of "country drainage" versus curb and gutter conveyance and pipe
- Bioretention Cells (includes Rain Gardens)
- Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- Treebox Filter
- Water Quality Swale
- Grass Channel
- Green Roof
- Other (describe): Infiltration Trench with Sediment Forebay

Standard 1: No New Untreated Discharges

- No new untreated discharges
- Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - Static
 - Simple Dynamic
 - Dynamic Field¹
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - Site is comprised solely of C and D soils and/or bedrock at the land surface
 - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - Solid Waste Landfill pursuant to 310 CMR 19.000
 - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

¹ 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - is within the Zone II or Interim Wellhead Protection Area
 - is near or to other critical areas
 - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - involves runoff from land uses with higher potential pollutant loads.
 - The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - The ½" or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - Limited Project
 - Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
 - Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

2. Project Overview

Introduction

This project proposes to build a 15,000 square foot 42 space parking lot in support of the Medical Office Building located at 255 Low Street. The parcel is currently vacant consisting of woodland and brush. The new parking lot will be accessed from the Medical Office Building parking lot.

Existing Conditions

The existing site is comprised of City of Newburyport Assessors tax map, Map 109 Lot 5C in the B1 zoning district. The parcel is 73,526 square feet with 21,616 square feet of bordering vegetated wetland. The parcel is wooded and brush with elevations on the property ranging from 57 to 46 based upon the datum NAVD 1988.

The project site is undeveloped wooded with 21,616 bordering vegetated wetland. Wetland lines have been delineated by Seekamp Environmental Services and were located on July and August, 2017.

The existing stormwater surface drainage runoff flows southerly across the parcel and eventually off the property at the southern corner of the property. The drainage flow line is shown on the existing drainage area figure. The soils on site consist of Deerfield loamy fine sand, hydrologic group A. See Appendix A for NCRS soil information and soil information on the site plan.

Project Description

The proposed development will consist of a 11,710 square feet of new bituminous concrete parking area with access from the existing Medical Office Building located north of the site. A small wall, 4 feet maximum height is required for the access ramp and portion of the proposed parking to minimize the site proposed disturbance. Concurrent with this Notice of Intent application the project will be permitted before the Newburyport Planning Board with Major Site Plan review. A stormwater system is proposed for the new development that includes infiltration basins under the proposed parking lot. Pretreatment is provided with deep sump catch basins and particle separators. The proposed stormwater system will mitigate peak runoff rates and volume for the 2, 10 and 100 year storm events along with providing a minimum of 80% total suspended solids removal.

3. Stormwater Management

Introduction

The current site consists of one subcatchment area. The total area being analyzed is 19,180 square feet. The existing and proposed area being analyzed consists of wooded upland area up gradient of the bordering vegetated wetland. The entire existing land surface is pervious.

According to the USDA Soil Survey, the majority of on-site soils consist of Deerfield loamy sand with a Hydrologic Soil Group "A".

An on-site soil assessment at the stormwater management areas in conformance with Volume 3, Chapter 1 of the Massachusetts Stormwater Handbook was performed in October, 2017. This

assessment indicated about 12" of loam topsoil over subsoil consisting of naturally occurring fine to medium sands. Groundwater was not found in the hand dug test holes down to 36 to 42 inches.

The proposed project increases impervious areas; multiple BMP's will be implemented. With the use of these BMP's, the project will comply with the ten standards of the DEP Stormwater Handbook.

Consistency with the DEP Stormwater Management Policy

The project is new development and therefore must meet all ten of the Stormwater Management Standards. Each of the standards of the DEP Stormwater Handbook and how the project meets or exceeds them is discussed below.

Standard 1 – Untreated Stormwater

Standard 1 states that *"No new stormwater conveyances (e.g. outfalls) will discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth."*

The proposed drainage system does not include new conveyances that discharge directly without pre-treatment. Several BMP's are proposed to treat stormwater and to prevent any erosion to the surrounding Resource Areas. Since no new conveyances will directly discharge untreated stormwater, the project meets this standard.

Standard 2 – Post Development Peak Discharge Rates

Standard 2 states that *"Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates."*

The site was analyzed under both the existing and proposed conditions to compare the pre and post development peak discharge rates at one design point leaving the property. The discharge point was analyzed to ensure that there is no impact on abutting properties as a result of the project. A detailed description of both the existing and proposed conditions hydrology is described below. A copy of the HydroCAD printouts for both existing and proposed conditions is included in Appendix B.

Existing Conditions Hydrology

The existing hydrology on site is in one subcatchment area. Subcatchments EX 1 flows from a high area flowing downgradient to the surrounding Bordering Vegetated Wetland. With small drainage area consisting of wooded surface area and drainage class "A" soils there is no runoff indicated from the property for the 2 and 10 year storm events.

Proposed Conditions Hydrology

The proposed drainage area is divided into two subcatchment areas directed to the two infiltration chamber systems. The chamber systems are very large in order to mitigate the new paved surface. All of the new paved areas will be directed to the new infiltration basins.

Summary

The mitigation measures include two infiltration chamber systems. These mitigation measures result in a stormwater management system that meets the requirements of Standard 2. The project does not increase flow rate for 2, 10 and 100 year design storm. The calculations are based upon the rainfall rates in the City of Newburyport Drainage regulations. A summary of the pre and post development discharge rates is shown on Table 1 below.

Table 2: Existing and Proposed Peak Discharge Rate Comparison at Design Points

DESIGN POINT 1 – To Offsite

	2 Year Storm - (3.10 in)		10 Year Storm - (4.70 in)		100 Year Storm - (8.30 in)	
Design Point	Existing (cfs)	Proposed (cfs)	Existing (cfs)	Proposed (cfs)	Existing (cfs)	Proposed (cfs)
1	0	0	0	0	0.07	0.03

Since the proposed project is designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates for the 2, 10 and 100 year storm events the project is in compliance with Standard 2.

Standard 3 – Recharge to Groundwater

Standard 3 states that *“Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This condition is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.”*

The volume of the recharge system was calculated according to the Massachusetts Stormwater Handbook. The proposed site design increases impervious area by 11,710 square feet. For this calculation, all impervious areas will be counted as being on Hydrologic Group A soils having a volume requirement of 0.6 inch of runoff inches multiplied by the new area of impervious cover. **This gives a required recharge volume of 586 cubic feet. The two infiltration systems provide 2,171 cubic feet of recharge volume. This volume exceeds the required amount to meet Standard 2.**

Standard 4 – Removal of 80% Total Suspended Solids (TSS)

Standard 4 states that *“Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when: (a) Suitable practices for source control and pollution prevention are identified in long-term pollution*

prevention plan, and thereafter implemented and maintained; (b) Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and (c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.”

Removal of Total Suspended Solids (TSS) is proposed for the developed areas of the site. TSS removal is accomplished by the combination of the following BMPs:

Infiltration chamber system #1 – The runoff to this basin is passed thru a deep sump catch basin and particle separator sediment prior to entering the Infiltration chamber system. 80% TSS removal is provided for this drainage area. This area requires 1/2” water quality volume (WQV) over the new impervious surfaces. The total impervious surface contributing to this basin is 7,620 sf with a required WQV of 318 cubic feet. Chamber System #1 provides 1,350 cubic feet of water quality volume. The required pretreatment of 44% TSS removal is achieved by passing runoff through the deep sump catch basin and particle separator prior to entering the chamber system.

Infiltration chamber system #2 – The runoff to this basin is passed thru a deep sump catch basin and particle separator sediment prior to entering the Infiltration chamber system. 80% TSS removal is provided for this drainage area. This area requires 1/2” water quality volume (WQV) over the new impervious surfaces. The total impervious surface contributing to this basin is 4,090 sf with a required WQV of 170 cubic feet. Chamber System #2 provides 822 cubic feet of water quality volume. The required pretreatment of 44% TSS removal is achieved by passing runoff through the deep sump catch basin and particle separator prior to entering the chamber system.

Standard 5 – Land Uses with Higher Potential Pollutant Loads

Standard 5 states that “For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook.”

The project use is not a Land Use with Higher Potential Pollutant Loads. Therefore, Standard 5 is not applicable to this project.

Standard 6 – Critical Areas

Standard 6 states that “Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the Massachusetts Stormwater Handbook.”

The project’s is not located in estimated habitat or any critical area.

Standard 7 - Redevelopment

Standard 7 states that “A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5 and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.”

The proposed project is in undeveloped area and therefore it does not meet the definition of a redevelopment, Standard 7 does not apply.

Standard 8 – Erosion and Sedimentation Controls

Standard 8 states that “A plan to control construction related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.”

A Stormwater Pollution Prevention Plan for the Project will be submitted prior to any land disturbance on the site.

Standard 9 – Operation and Maintenance Plans

Standard 9 states: “A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed. “

A long-term operation and maintenance plan is included in Appendix C. The Plan includes provisions for Construction-Phase measures, as well as long term maintenance and inspections. Therefore the Project complies with Standard 9.

Standard 10 – Illicit Discharges to Drainage System

Standard 10 states: “All illicit discharges to the stormwater management system are prohibited.”

There are no known or suspected illicit discharges to the stormwater management system at the project site. Therefore the Project complies with Standard 10.

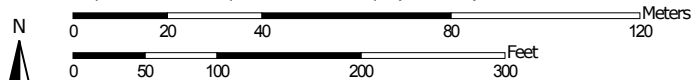
Appendix A

USDA NRCS Soil Map & Soil Descriptions

Soil Map—Essex County, Massachusetts, Northern Part



Map Scale: 1:1,600 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84


MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Northern Part

Survey Area Data: Version 12, Sep 14, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Sep 12, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Essex County, Massachusetts, Northern Part (MA605)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	1.5	15.5%
12A	Maybid silt loam, 0 to 3 percent slopes	0.3	3.3%
32A	Wareham loamy sand, 0 to 3 percent slopes	0.3	2.9%
255B	Windsor loamy sand, 3 to 8 percent slopes	3.0	30.6%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	4.3	43.8%
275B	Agawam fine sandy loam, 3 to 8 percent slopes	0.2	2.1%
651	Udorthents, smoothed	0.2	1.8%
Totals for Area of Interest		9.9	100.0%

Essex County, Massachusetts, Northern Part

256A—Deerfield loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vj7g

Elevation: 0 to 1,000 feet

Mean annual precipitation: 45 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Deerfield and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deerfield

Setting

Landform: Terraces

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Loose sandy glaciofluvial deposits derived from granite and gneiss

Typical profile

H1 - 0 to 9 inches: loamy fine sand

H2 - 9 to 33 inches: loamy fine sand

H3 - 33 to 60 inches: stratified sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)

Depth to water table: About 12 to 36 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 15 percent

Hydric soil rating: No

Wareham

Percent of map unit: 5 percent

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Essex County, Massachusetts, Northern Part

Survey Area Data: Version 12, Sep 14, 2016

TP17-1 DEEP OBSERVATION HOLE

255 Low Street, Newburyport, Massachusetts

Date: November 04, 2017 Time: 10:45 Weather: Partly cloudy, ~53°F, calm
 Position on landscape: Toeslope; tread Slope aspect: Southerly Land cover: Brush and trees; lightly wooded
 Property line: 10⁺ feet Drainage way: 50⁺ feet Drinking water well: 100⁺ feet
 Wetlands: 50⁺ feet Open water body: 400⁺ feet Neighboring septic system: 50⁺ feet
 Public water supply reservoir: 400⁺ feet Tributary to reservoir: 200⁺ feet
 Hydrologic Soil Group: A Drainage Class: Moderately well drained Soil Moisture Status: Damp
 Soil map unit: 256A – Deerfield loamy fine sand (sandy, mixed, mesic Aquic Udipsamments), 0-3% slopes
 Depth to bedrock: >43" Seasonal High Groundwater Table: 42" Apparent water table (weep): N.O.

SOIL PROFILE ► TP17-1

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (EarthColors)	Redoxomorphic Features from ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 15"	A	Sandy Loam	10YR 3/2 very dark grayish brown	<i>none observed</i>	Very friable; moderate-grade fine-to-medium subangular granular structure; somewhat cohesive matrix; fine grained mineral content; damp; nonplastic; nonsticky; many brush, shrub and tree roots; free of clasts; clear wavy boundary.
15 → 23"	B _w	Loamy Sand	10YR4/4 dark yellow brown	<i>none observed</i>	Very friable; weak-grade fine-to-medium blocky structure; weak cohesive matrix; slightly gritty; mixed very fine-to-fine grained mineral content; damp; free of clasts; nonsticky; nonplastic; diffuse wavy boundary.
23 → 43"	2C	Loamy Sand	2.5Y5/6 lite olive brown	@ 42" m,2,p 7.5R5/8 10Y7/1	Loose; structurless; unstable; mixed fine-to-medium grained mineral content; damp matrix; nonplastic; nonsticky; well stratified and poorly graded; free of clasts; stratified beds gently dipping to the Southeast; no apparent water observed and no refusal at test hole depth.

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker License #1848

Printed name of evaluator & license number

June 1998

Date of Soil Evaluator Certification

10/04/17

Date of soil testing

TP17-2 DEEP OBSERVATION HOLE

255 Low Street, Newburyport, Massachusetts

Date: November 04, 2017 Time: 10:58 Weather: Partly cloudy, ~53°F, calm
 Position on landscape: Toeslope; tread Slope aspect: Southerly Land cover: Brush and trees; lightly wooded
 Property line: 10⁺ feet Drainage way: 50⁺ feet Drinking water well: 100⁺ feet
 Wetlands: 50⁺ feet Open water body: 400⁺ feet Neighboring septic system: 50⁺ feet
 Public water supply reservoir: 400⁺ feet Tributary to reservoir: 200⁺ feet
 Hydrologic Soil Group: A Drainage Class: Moderately well drained Soil Moisture Status: Damp
 Soil map unit: 256A – Deerfield loamy fine sand (sandy, mixed, mesic Aquic Udipsamments), 0-3% slopes
 Depth to bedrock: ≥46" Seasonal High Groundwater Table: 40" Apparent water table (weep): N.O.

SOIL PROFILE ► TP17-2

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (EarthColors)	Redoxomorphic Features from ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 10"	A	Sandy Loam	10YR 3/2 very dark grayish brown	<i>none observed</i>	Very friable; moderate-grade fine-to-medium subangular granular structure; somewhat cohesive matrix; fine grained mineral content; damp; nonplastic; nonsticky; many brush, shrub and tree roots; free of clasts; clear wavy boundary.
10 → 16"	B _w	Loamy Sand	10YR4/4 dark yellow brown	<i>none observed</i>	Very friable; weak-grade fine-to-medium blocky structure; weak cohesive matrix; slightly gritty; mixed very fine-to-fine grained mineral content; damp; free of clasts; nonsticky; nonplastic; diffuse wavy boundary.
16 → 46"	2C	Loamy Sand	2.5Y5/6 lite olive brown	@ 40" m,2,p 7.5R5/8 10Y7/1	Loose; structurless; unstable; mixed fine-to-medium grained mineral content; damp matrix; nonplastic; nonsticky; well stratified and poorly graded; free of clasts; stratified beds gently dipping to the Southeast; no apparent water observed and no refusal at test hole depth.

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker License #1848

Printed name of evaluator & license number

June 1998

Date of Soil Evaluator Certification

10/04/17

Date of soil testing

TP17-3 DEEP OBSERVATION HOLE

255 Low Street, Newburyport, Massachusetts

Date: November 04, 2017 Time: 11:11 Weather: Partly cloudy, ~53°F, calm
 Position on landscape: Toeslope; tread Slope aspect: Southerly Land cover: Brush and trees; lightly wooded
 Property line: 10⁺ feet Drainage way: 50⁺ feet Drinking water well: 100⁺ feet
 Wetlands: 50⁺ feet Open water body: 400⁺ feet Neighboring septic system: 50⁺ feet
 Public water supply reservoir: 400⁺ feet Tributary to reservoir: 200⁺ feet
 Hydrologic Soil Group: A Drainage Class: Moderately well drained Soil Moisture Status: Damp
 Soil map unit: 256A – Deerfield loamy fine sand (sandy, mixed, mesic Aquic Udipsamments), 0-3% slopes
 Depth to bedrock: >42" Seasonal High Groundwater Table: 39" Apparent water table (weep): N.O.

SOIL PROFILE ► TP17-3

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (EarthColors)	Redoxomorphic Features from ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 10"	A	Sandy Loam	10YR 3/2 very dark grayish brown	<i>none observed</i>	Very friable; moderate-grade fine-to-medium subangular granular structure; somewhat cohesive matrix; fine grained mineral content; damp; nonplastic; nonsticky; many brush, shrub and tree roots; free of clasts; clear wavy boundary.
10 → 17"	B _w	Loamy Sand	10YR4/4 dark yellow brown	<i>none observed</i>	Very friable; weak-grade fine-to-medium blocky structure; weak cohesive matrix; slightly gritty; mixed very fine-to-fine grained mineral content; damp; free of clasts; nonsticky; nonplastic; diffuse wavy boundary.
17 → 42"	2C	Loamy Sand	2.5Y5/6 lite olive brown	@ 39" m,2,p 7.5R5/8 10Y7/1	Loose; structurless; unstable; mixed fine-to-medium grained mineral content; damp matrix; nonplastic; nonsticky; well stratified and poorly graded; free of clasts; stratified beds gently dipping to the Southeast; no apparent water observed and no refusal at test hole depth.

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker License #1848

Printed name of evaluator & license number

June 1998

Date of Soil Evaluator Certification

10/04/17

Date of soil testing

TP17-4 DEEP OBSERVATION HOLE

255 Low Street, Newburyport, Massachusetts

Date: November 04, 2017 Time: 11:19 Weather: Partly cloudy, ~53°F, calm
 Position on landscape: Toeslope; tread Slope aspect: Southerly Land cover: Brush and trees; lightly wooded
 Property line: 10⁺ feet Drainage way: 50⁺ feet Drinking water well: 100⁺ feet
 Wetlands: 50⁺ feet Open water body: 400⁺ feet Neighboring septic system: 50⁺ feet
 Public water supply reservoir: 400⁺ feet Tributary to reservoir: 200⁺ feet
 Hydrologic Soil Group: A Drainage Class: Moderately well drained Soil Moisture Status: Damp
 Soil map unit: 256A – Deerfield loamy fine sand (sandy, mixed, mesic Aquic Udipsamments), 0-3% slopes
 Depth to bedrock: ≥40" Seasonal High Groundwater Table: 27" Apparent water table (weep): N.O.

SOIL PROFILE ► TP17-4

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (EarthColors)	Redoxomorphic Features from ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 09"	A	Sandy Loam	10YR 3/2 very dark grayish brown	<i>none observed</i>	Very friable; moderate-grade fine-to-medium subangular granular structure; somewhat cohesive matrix; fine grained mineral content; damp; nonplastic; nonsticky; many brush, shrub and tree roots; free of clasts; clear wavy boundary.
09 → 20"	B _w	Loamy Sand	10YR4/4 dark yellow brown	<i>none observed</i>	Very friable; weak-grade fine-to-medium blocky structure; weak cohesive matrix; slightly gritty; mixed very fine-to-fine grained mineral content; damp; free of clasts; nonsticky; nonplastic; diffuse wavy boundary.
20 → 40"	2C	Sandy loam	2.5Y5/4 lite olive brown	@ 27" m,2,p 7.5R5/8 10Y7/1	Very friable; massive; mixed very fine-to-fine grained mineral content; damp matrix; nonplastic; nonsticky; somewhat stratified and poorly graded; somewhat dense matrix; free of clasts; no apparent water observed and no refusal at test hole depth.

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker License #1848

Printed name of evaluator & license number

June 1998

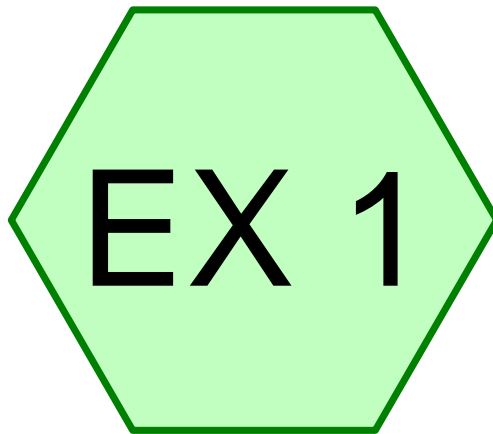
Date of Soil Evaluator Certification

10/04/17

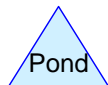
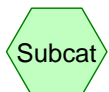
Date of soil testing

Appendix B

HydroCAD Hydrology Printout



EXIST



255 Low Existing

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Page 2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
19,180	30	Woods, Good, HSG A (EX 1)
19,180		TOTAL AREA

255 Low Existing

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Type III 24-hr 100 Year Rainfall=8.30"

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Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX 1: EXIST

Runoff Area=19,180 sf 0.00% Impervious Runoff Depth>0.49"
Flow Length=150' Tc=11.0 min CN=30/0 Runoff=0.07 cfs 778 cf

Total Runoff Area = 19,180 sf Runoff Volume = 778 cf Average Runoff Depth = 0.49"
100.00% Pervious = 19,180 sf 0.00% Impervious = 0 sf

255 Low Existing

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Type III 24-hr 100 Year Rainfall=8.30"

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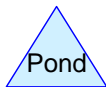
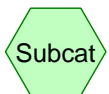
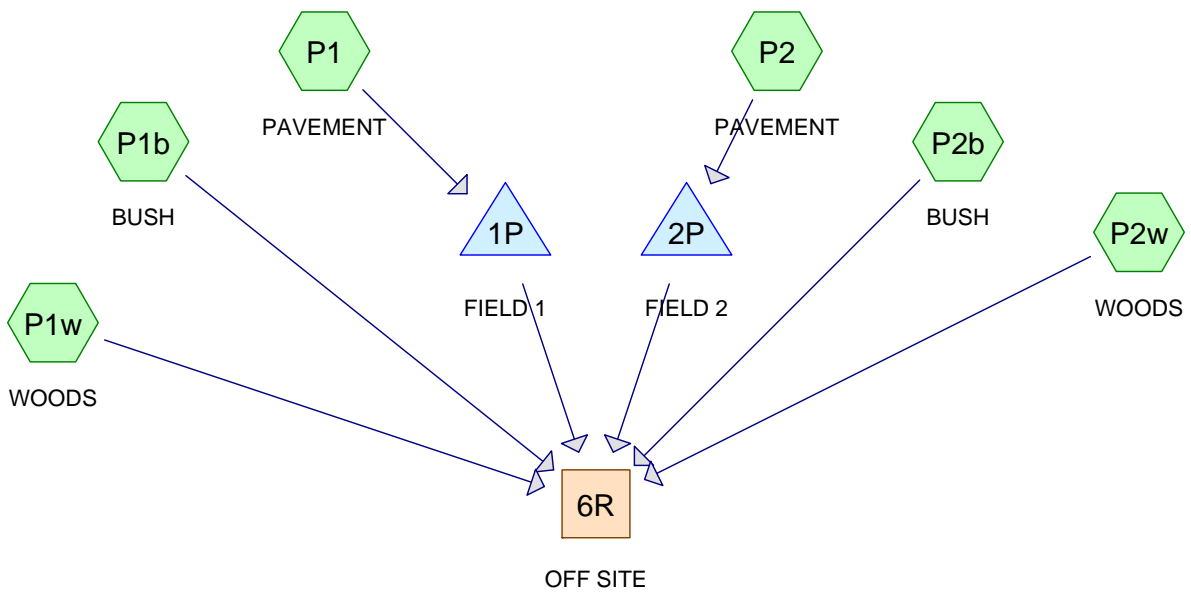
Summary for Subcatchment EX 1: EXIST

Runoff = 0.07 cfs @ 12.47 hrs, Volume= 778 cf, Depth> 0.49"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.30"

Area (sf)	CN	Description
19,180	30	Woods, Good, HSG A
19,180	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	50	0.0450	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
2.1	100	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.0	150	Total			



Drainage Diagram for 255 Low Prop
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
3,184	30	Brush, Good, HSG A (P1b, P2b)
4,286	30	Woods, Good, HSG A (P1w, P2w)
11,710	98	Paved parking, HSG A (P1, P2)
19,180		TOTAL AREA

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Type III 24-hr 100 Year Rainfall=8.30"

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Time span=2.00-24.00 hrs, dt=0.01 hrs, 2201 points
 Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: PAVEMENT	Runoff Area=7,620 sf 100.00% Impervious Runoff Depth>8.01" Tc=6.0 min CN=0/98 Runoff=1.43 cfs 5,087 cf
Subcatchment P1b: BUSH	Runoff Area=1,130 sf 0.00% Impervious Runoff Depth>0.49" Tc=6.0 min CN=30/0 Runoff=0.00 cfs 46 cf
Subcatchment P1w: WOODS	Runoff Area=980 sf 0.00% Impervious Runoff Depth>0.49" Tc=6.0 min CN=30/0 Runoff=0.00 cfs 40 cf
Subcatchment P2: PAVEMENT	Runoff Area=4,090 sf 100.00% Impervious Runoff Depth>8.01" Tc=6.0 min CN=0/98 Runoff=0.77 cfs 2,730 cf
Subcatchment P2b: BUSH	Runoff Area=2,054 sf 0.00% Impervious Runoff Depth>0.49" Tc=6.0 min CN=30/0 Runoff=0.01 cfs 84 cf
Subcatchment P2w: WOODS	Runoff Area=3,306 sf 0.00% Impervious Runoff Depth>0.49" Tc=6.0 min CN=30/0 Runoff=0.01 cfs 134 cf
Reach 6R: OFF SITE	Inflow=0.03 cfs 304 cf Outflow=0.03 cfs 304 cf
Pond 1P: FIELD 1	Peak Elev=58.03' Storage=1,293 cf Inflow=1.43 cfs 5,087 cf Discarded=0.23 cfs 5,087 cf Primary=0.00 cfs 0 cf Outflow=0.23 cfs 5,087 cf
Pond 2P: FIELD 2	Peak Elev=55.95' Storage=637 cf Inflow=0.77 cfs 2,730 cf Discarded=0.14 cfs 2,730 cf Primary=0.00 cfs 0 cf Outflow=0.14 cfs 2,730 cf

Total Runoff Area = 19,180 sf Runoff Volume = 8,121 cf Average Runoff Depth = 5.08"
38.95% Pervious = 7,470 sf 61.05% Impervious = 11,710 sf

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Type III 24-hr 100 Year Rainfall=8.30"

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Summary for Subcatchment P1: PAVEMENT

Runoff = 1.43 cfs @ 12.08 hrs, Volume= 5,087 cf, Depth> 8.01"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.30"

Area (sf)	CN	Description
7,620	98	Paved parking, HSG A
7,620	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Summary for Subcatchment P1b: BUSH

Runoff = 0.00 cfs @ 12.39 hrs, Volume= 46 cf, Depth> 0.49"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.30"

Area (sf)	CN	Description
1,130	30	Brush, Good, HSG A
1,130	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Summary for Subcatchment P1w: WOODS

Runoff = 0.00 cfs @ 12.39 hrs, Volume= 40 cf, Depth> 0.49"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.30"

Area (sf)	CN	Description
980	30	Woods, Good, HSG A
980	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

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Type III 24-hr 100 Year Rainfall=8.30"

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Summary for Subcatchment P2: PAVEMENT

Runoff = 0.77 cfs @ 12.08 hrs, Volume= 2,730 cf, Depth> 8.01"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.30"

Area (sf)	CN	Description
4,090	98	Paved parking, HSG A
4,090	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Summary for Subcatchment P2b: BUSH

Runoff = 0.01 cfs @ 12.39 hrs, Volume= 84 cf, Depth> 0.49"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.30"

Area (sf)	CN	Description
2,054	30	Brush, Good, HSG A
2,054	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Summary for Subcatchment P2w: WOODS

Runoff = 0.01 cfs @ 12.39 hrs, Volume= 134 cf, Depth> 0.49"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.30"

Area (sf)	CN	Description
3,306	30	Woods, Good, HSG A
3,306	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

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Type III 24-hr 100 Year Rainfall=8.30"

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Summary for Reach 6R: OFF SITE

Inflow Area = 19,180 sf, 61.05% Impervious, Inflow Depth > 0.19" for 100 Year event
 Inflow = 0.03 cfs @ 12.39 hrs, Volume= 304 cf
 Outflow = 0.03 cfs @ 12.39 hrs, Volume= 304 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: FIELD 1

Inflow Area = 7,620 sf, 100.00% Impervious, Inflow Depth > 8.01" for 100 Year event
 Inflow = 1.43 cfs @ 12.08 hrs, Volume= 5,087 cf
 Outflow = 0.23 cfs @ 11.65 hrs, Volume= 5,087 cf, Atten= 84%, Lag= 0.0 min
 Discarded = 0.23 cfs @ 11.65 hrs, Volume= 5,087 cf
 Primary = 0.00 cfs @ 2.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 58.03' @ 12.55 hrs Surf.Area= 1,222 sf Storage= 1,293 cf

Plug-Flow detention time= 29.1 min calculated for 5,086 cf (100% of inflow)
 Center-of-Mass det. time= 29.0 min (772.7 - 743.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	56.10'	763 cf	26.00'W x 47.00'L x 2.04'H Field A 2,495 cf Overall - 586 cf Embedded = 1,909 cf x 40.0% Voids
#2A	56.60'	586 cf	Cultec C-100 x 42 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
		1,350 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.10'	8.270 in/hr Exfiltration over Surface area
#2	Primary	58.10'	2.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.23 cfs @ 11.65 hrs HW=56.12' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.00 cfs @ 2.00 hrs HW=56.10' (Free Discharge)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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Type III 24-hr 100 Year Rainfall=8.30"

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Summary for Pond 2P: FIELD 2

Inflow Area = 4,090 sf, 100.00% Impervious, Inflow Depth > 8.01" for 100 Year event
 Inflow = 0.77 cfs @ 12.08 hrs, Volume= 2,730 cf
 Outflow = 0.14 cfs @ 11.68 hrs, Volume= 2,730 cf, Atten= 81%, Lag= 0.0 min
 Discarded = 0.14 cfs @ 11.68 hrs, Volume= 2,730 cf
 Primary = 0.00 cfs @ 2.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 55.95' @ 12.52 hrs Surf.Area= 751 sf Storage= 637 cf

Plug-Flow detention time= 22.1 min calculated for 2,729 cf (100% of inflow)
 Center-of-Mass det. time= 22.0 min (765.7 - 743.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	54.52'	473 cf	19.00'W x 39.50'L x 2.04'H Field A 1,532 cf Overall - 349 cf Embedded = 1,183 cf x 40.0% Voids
#2A	55.02'	349 cf	Cultec C-100 x 25 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
		822 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	54.52'	8.270 in/hr Exfiltration over Surface area
#2	Primary	56.52'	2.0' long x 2.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.14 cfs @ 11.68 hrs HW=54.54' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 2.00 hrs HW=54.52' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Appendix C

Operation & Maintenance Plan

STORMWATER MANAGEMENT OPERATION AND MAINTENANCE PLAN

255R Low Street
Newburyport, Massachusetts

The following Stormwater Management Operation and Maintenance (O&M) Plan has been prepared to operate and maintain the stormwater management system for the proposed parking located at 255R Low Street

Owner/Operator: Low Street Redevelopment
#255 Low Street

Inspection and Maintenance Schedule

Personnel entrusted by the owner/operator with stormwater maintenance shall inspect the stormwater management system on a routine basis not less than once per month for the first 6 months of operation and semi-annually thereafter. Refer to the Design Plans for stormwater measure information. Inspection and maintenance shall be performed as follows:

1. Landscaped Areas shall be inspected and maintained on a monthly basis. Areas which may be subject to erosion will be stabilized and reseeded immediately. These operations will be performed as part of ongoing routine grounds maintenance operations.
2. Street Sweeping of drives and parking areas shall be conducted biannually, once in the fall during month of November after foliage has dropped and in April after the last snowfall. Removed sediment will be disposed off-site by a qualified waste disposal contractor in accordance with state and federal regulations.
3. Catch Basins & Particle Separators: Catch Basins shall be inspected twice per year and at the end of foliage season and spring after the last snowfall. Remove floatables stored on the surface of the water with the vactor hose or the skimmer net. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor. Dispose of sediments in accordance with all applicable local and state regulations
4. Infiltration Chambers: During first year visually inspect after each major storm (>1.5") and again 72 hours later to verify exfiltration is occurring as designed. Note if water remains in basin after 72 hours. After first year visually inspect twice per year. Infiltration Systems shall be inspected for accumulation of silt, sediment, standing water, or debris on an annual basis. Debris and sediment shall be removed.
5. Snow Removal and Storage: During the winter months, snow shall be plowed and piled within the paved area only as to melt and be treated and infiltrated during melting periods. If excess snow piles exist they shall be trucked from the parking lot

Stormwater System Inspection Report

General Information			
Location: 255R Low Street, Newburyport			
Date of Inspection		Start/End Time	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Purpose of Inspection			
Weather Information			
Has it rained since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No			
Weather at time of this inspection?			

Site-Specific Stormwater Devices

	Description	Installed and Operating Properly?	Corrective Action Needed	Date for Corrective Action/Responsible Person
1		<input type="checkbox"/> Yes <input type="checkbox"/> No		
2		<input type="checkbox"/> Yes <input type="checkbox"/> No		
3		<input type="checkbox"/> Yes <input type="checkbox"/> No		
4		<input type="checkbox"/> Yes <input type="checkbox"/> No		
5		<input type="checkbox"/> Yes <input type="checkbox"/> No		
6		<input type="checkbox"/> Yes <input type="checkbox"/> No		
7		<input type="checkbox"/> Yes <input type="checkbox"/> No		
8		<input type="checkbox"/> Yes <input type="checkbox"/> No		
9		<input type="checkbox"/> Yes <input type="checkbox"/> No		

Overall Site Issues

	Description		Corrective Action	Date for Corrective Action/Responsible Person
1	Are all slopes properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
2	Are natural resource areas (e.g., streams, wetlands, etc.) being subjected to erosion?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
3	Are discharge points free of sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No		

Certification Statement:

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

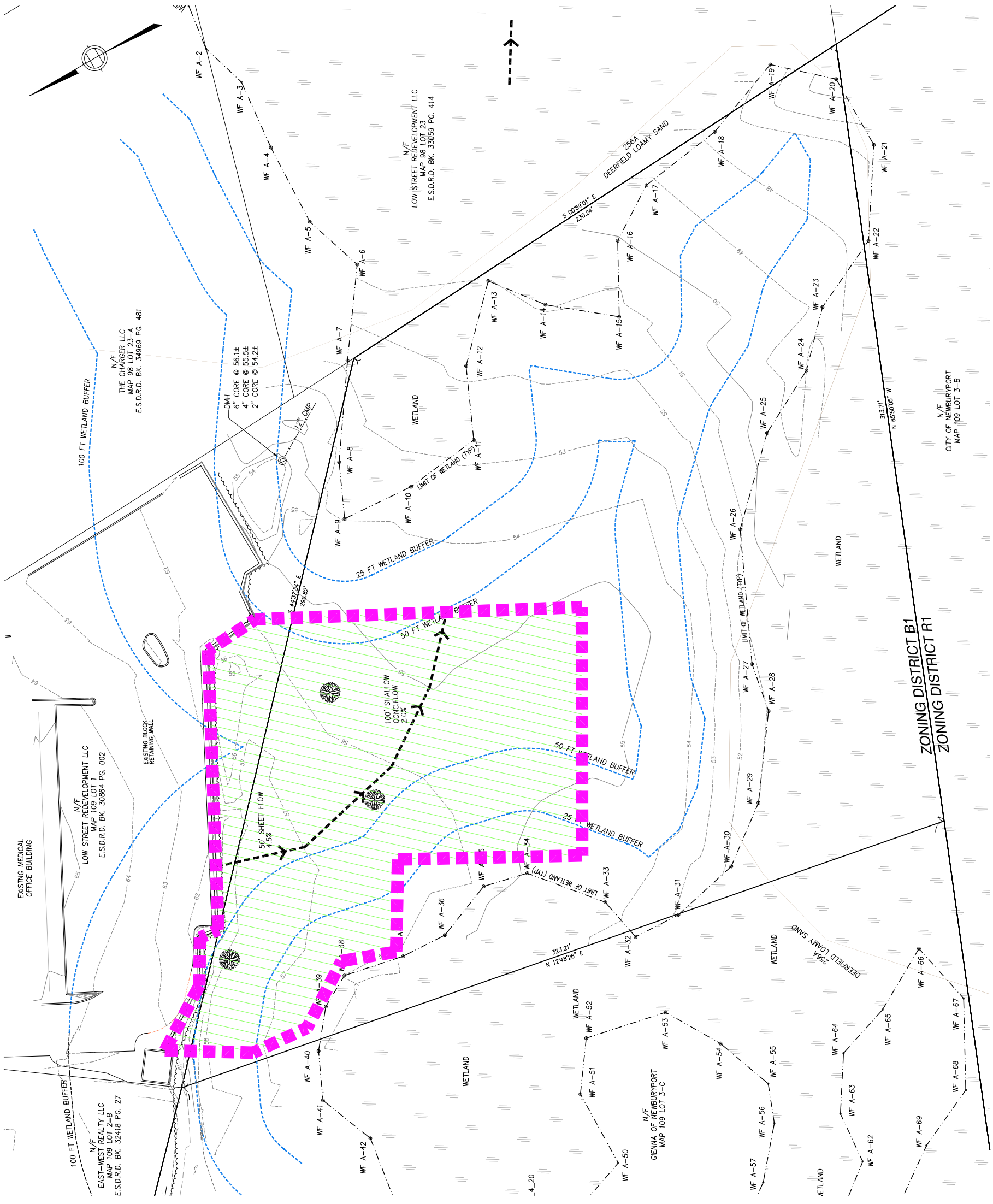
Print name: _____

Signature: _____

Date: _____

Appendix D

Figure 1 – Pre & Post Development Drainage Areas



100 FT WETLAND BUFFER

THE CHARGER LLC
MAP 98 LOT 23-A
E.S.D.R.D. BK. 34969 PG. 481

DMH
6" CORE @ 56.1±
4" CORE @ 55.5±
2" CORE @ 54.2±

100' SHALLOW CONC-FLOW
2.0%

25 FT WETLAND BUFFER

50 FT WETLAND BUFFER

50' SHEET FLOW
4.5%

100 FT WETLAND BUFFER

DEERFIELD LOAMY SAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

100 FT WETLAND BUFFER

EAST-WEST REALTY LLC
MAP 109 LOT 2-B
E.S.D.R.D. BK. 32418 PG. 27

EXISTING MEDICAL OFFICE BUILDING

EXISTING BLOCK RETAINING WALL

LOW STREET REDEVELOPMENT LLC
MAP 109 LOT 1
E.S.D.R.D. BK. 30864 PG. 002

LOW STREET REDEVELOPMENT LLC
MAP 98 LOT 23
E.S.D.R.D. BK. 33059 PG. 414

DEERFIELD LOAMY SAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

WETLAND

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WETLAND

WETLAND

WETLAND

100 FT WETLAND BUFFER

LOW STREET REDEVELOPMENT LLC
MAP 109 LOT 1
E.S.D.R.D. BK. 30864 PG. 002

EXISTING MEDICAL OFFICE BUILDING

EXISTING BLOCK RETAINING WALL

LOW STREET REDEVELOPMENT LLC
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LOW STREET REDEVELOPMENT LLC
MAP 98 LOT 23
E.S.D.R.D. BK. 33059 PG. 414

DEERFIELD LOAMY SAND

WETLAND

WETLAND

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100 FT WETLAND BUFFER

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DEERFIELD LOAMY SAND

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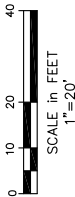
WETLAND

WETLAND

WETLAND

WETLAND

EXISTING DRAINAGE AREAS
DRAINAGE CLASS "A" WOODS GOOD CONDITION-19,180 SF



PROJECT NO. 2017-MEDICAL		PLAN OF LAND IN NEWBURYPORT, MASSACHUSETTS	
DATE: JAN. 29, 2017		PREPARED FOR LOW STREET REDEVELOPMENT LLC	
SHEET NO. 1 OF 1			

EXISTING DRAINAGE AREAS	
255 LOW STREET (REAR)	

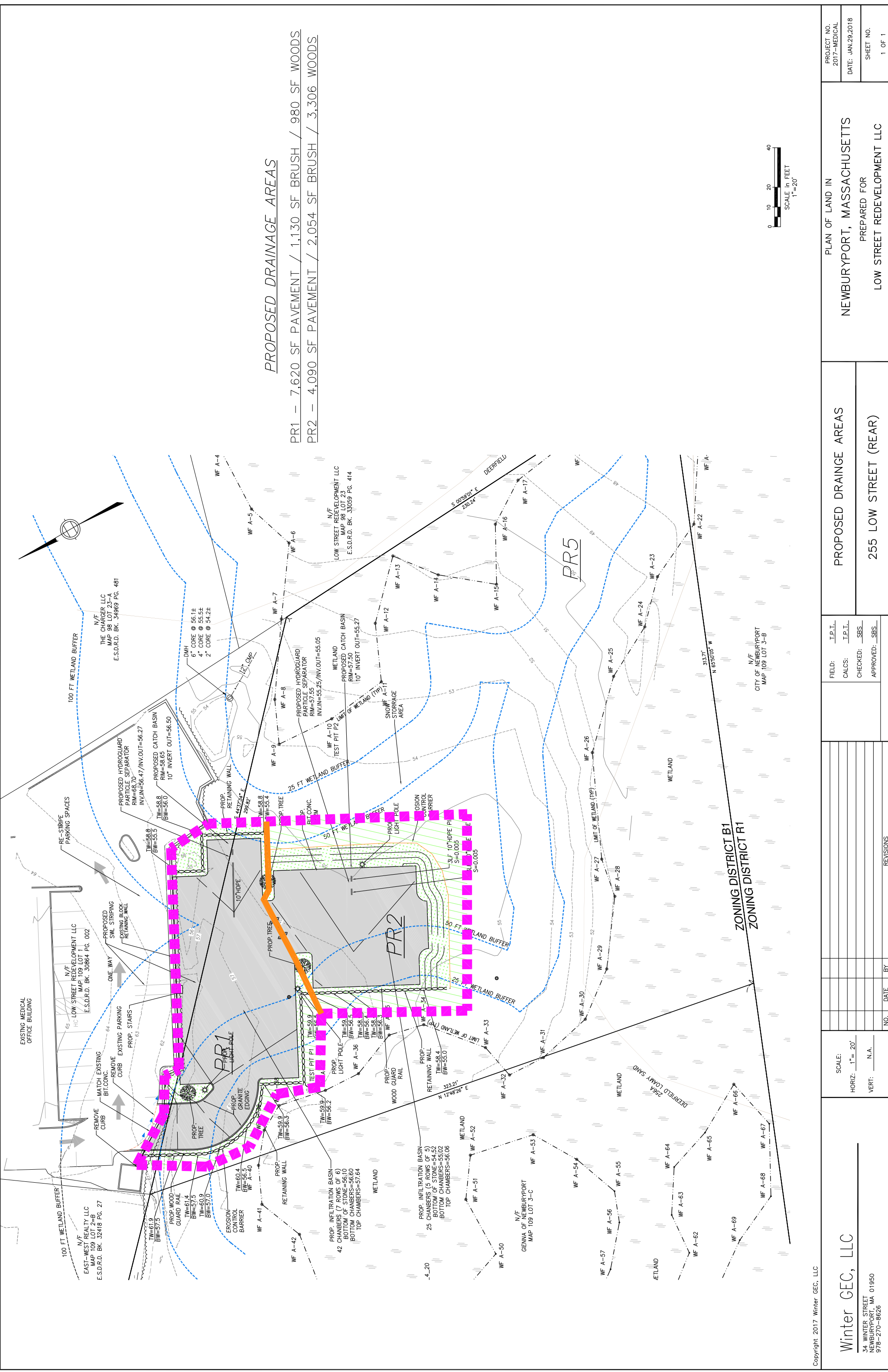
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APPROVED:	SBS

NO.	DATE	BY	REVISIONS

SCALE:	HORIZ: 1" = 20'
VERT:	N.A.

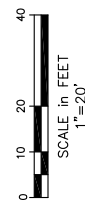
Winter GEC, LLC
34 WINTER STREET
NEWBURYPORT, MA 01950
978-270-8626

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PROPOSED DRAINAGE AREAS

PR1 — 7,620 SF PAVEMENT / 1,130 SF BRUSH / 980 SF WOODS
 PR2 — 4,090 SF PAVEMENT / 2,054 SF BRUSH / 3,306 WOODS



SCALE: _____
 HORIZ: 1" = 20'
 VERT: N.A.

NO.	DATE	BY	REVISIONS

FIELD:	I.P.L.
CALCS:	I.P.L.
CHECKED:	SBS
APPROVED:	SBS

PROPOSED DRAINAGE AREAS
 255 LOW STREET (REAR)